subsequent calcite at around 750° C., fulfilling a double function as catalyst and binding agent.

Typically, the catalytic activity of the sensing elements is enhanced by repeatedly heating the elements at a higher temperature than the operating temperature of between 700° C. and 800° C. in a methane/air mixture, for approximately two minutes at a time.

The binding agent may be a colloidal silica dispersion of 15% to 30% by weight content and average silica particle size in the region of 8 nm, binding being accomplished by heading the sensing element, after the paste or slurry has been deposited onto the conductive element, to a temperature of 900° C. to 1000° C.

In one form of the invention, an organic solvent is combined with ethyl cellulose, the alga and the glass frit to obtain a paste, which is stenciled onto the conductive element and calcined in air at a temperature of 600° C. to 800° C.

The catalyst may be prepared by calcination with an alumina precursor and an acid, in which activated alumina is mixed in a predetermined ratio of approximately 2:1 by weight, with the addition of 1% or less by weight of a pelting agent, with calcination taking place in air at 700° C. to 800° C. for approximately 30 minutes.

Advantageously, the method includes the step of spraying a solution of the catalyst and carrier paste through an aligned shadow mask onto the track from both sides of the base.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** shows a schematic perspective view of a first embodiment of a detector of the invention;

FIG. **2** shows a perspective view of a second embodiment of a detector of the invention;

FIG. **3** shows a top plan view of a third embodiment of a detector of the invention;

FIG. **4**A to **4**C show alternative cross sectional views on the line A—A of FIG. **3**;

FIG. **5**A and **5**B show top plan views of a fourth embodiment of a detector of the invention;

FIG. **6**A to **6**K show cross-section and perspective views of various stages in a first embodiment of a method of manufacturing a detector of the invention;

FIG. **7**A to **7**L show cross-sectional and perspective views of various stages in a second embodiment of a method of manufacturing a detector of the invention;

FIG. **8**A to **8**E show cross-sectional views of various stages in a third embodiment of a method of manufacturing a detector; and

FIG. **9** shows a top plan view of the completed detector of FIG. **8**E.

DESCRIPTION OF EMBODIMENTS

Referring first to FIG. **1**, a first rudimentary embodiment of a detector **10** is shown comprising a substrate **12** formed from a **(100)** oriented silicon wafer using conventional semi-conductor processing techniques. The substrate is between 0.3 and 0.5 milimetres thick, and has a membrane **14** deposited on its uppermost surface. The membrane may be formed from one or more layers of different materials comprising a refractory oxide, a nitride or a combination thereof. Suitable materials are typically SiO_2, Si_3N_4, SiON, Al_3N_4, TiN and Al_2O_3.

An atomic diffusion layer may also be provided, for which Ti/W, Ti/W-N or Al_2O_3 may be used. The composition of the membrane is a key factor in the successful operation of the sensor, and must have certain properties, including low thermal conductivity, good adhesion, thermal shock resistance, matched thermal expansion to silicon and to platinum low atomic diffusively, mechanical strength free of mechanical stress and low electrical conductivity. Such properties are displayed by some of the materials described above.

A temperature sensing element **16** bridges a cavity **18** etched through the centre of the substrate **12** and the membrane **14**. The temperature sensor **16**, which doubles as a heater element, comprises a central free-standing meander **20** and a pair of terminal pads **22** and **24** resting on the membrane **14** and supporting the meander **20** via bridging leads **26**. In order to provide long term adhesion at elevated temperatures between the membrane **14** and the meander **20**, additional metallic or oxide adhesion layers may be required, where these are not provided by the division layer. Typically, such layers will be formed from Ti/W, Cr, NiCr or Al_2O_3.

In order to minimize thermal losses and to provide sensors with the lowest possible power consumption and relatively quick response times, silicon is removed from the substrate so as to provide the recess **18**. Any method of silicon removal commonly used in semiconductor manufacturing processes may be adopted. Typically, the anisotropic etching characteristics of **(1-0-0)** silicon in certain wet etching techniques are employed to provide precise wall angles and final dimensions.

In FIG. **2**, a free-standing meander **34** is shown in which all of the membrane material is removed from beneath the sensor element **36** so as to define a cavity **37**. Free suspension of the meander results in minimum heat losses. Structural strength is achieved by increasing the thicknesses of the leads **38** which extend between the terminal pads **30** and the meander **34**. It is clear from FIG. **2** how the structural strength of the electrical bridging leads **38** is increased by forming them with a U-shaped profile. The U-shaped profile provides a reduced thermal conducting area so as to reduce conductive heat loss through the leads. The leads **38** may be thickened either by sputtering, electroplating or electroless-plating methods.

In the simplest embodiments of the sensor illustrated in FIGS. **1** and **2**, the functions of the heater and the temperature sensing elements **16** are combined by using a meandering track of pure platinum or an alloy thereof.

The geometry and thickness of the platinum meander are chosen so as to provide an optimum sensitivity for the sensor as a compromise between the heater and temperature sensing elements.

An ideal heater material differs substantially from an ideal temperature sensing material which operates on the principle of linear changes in resistivity due to temperature changes. Heater operation is based on a high resistivity material releasing heat in response to an electrical current passing through the materials with the result that an ideal heater material must have the properties of high electrical resistivity, resistance against electro-migration and a low temperature co-efficient of resistance. In contrast, an ideal temperature sensing material has a temperature co-efficient of resistance which is both high and linear.

In FIG. **3** an alternative embodiment of a free-standing temperature sensor and heater **40** is shown, and is in the form of an H-shaped configuration in which the recess **38** is spanned by parallel leads **42**. The leads may have a flat cross-sectional profile of the type illustrated in FIG. **4**A. Alternatively, the structural strength of the leads **42** may be